

Efficiency Through Programming: Calculating Election Rates for Guaranteed Insurability

An Honors Thesis (HONR 499)

by

Sabrina Weislak

Thesis Advisor

Kevin Gatzlaff

A handwritten signature in dark ink, appearing to read 'Kevin Gatzlaff', with a stylized, cursive script.

**Ball State University
Muncie, Indiana**

December, 2014

Expected Date of Graduation

December, 2014

Undergrad
Thesis
LD
2489
.Z4
2014
.W455

Abstract

In order to increase efficiency, companies are continually developing new computer programs and processes. Insurance companies, in particular, depend upon software languages to implement calculations and studies of historical data. Such studies allow observation of data trends and necessary rate changes. Analysis of election rates on policyholders' Guaranteed Insurability option is an interesting study for insurance companies, with results implemented in the accompanying pricing model for this option. Shortcomings can be found, however, in companies' studies. I realized the inefficiencies of my employer's Guaranteed Insurability study through my internship this past summer. By creating a Statistical Analysis System program to analyze election rates, I observe this company's current procedure and construct a more proficient process for analysis.

Acknowledgements

I would like to thank Kevin Gatzlaff for his helpful advice throughout the creation of various drafts of this paper. His knowledge and experience with communication of insurance topics was indispensable.

I would like to thank Andrew, my intern supervisor, and Tony, my manager, for their months of guidance and support this summer as I slowly grinded through this complicated, and sometimes frustrating, task.

Table of Contents

Guaranteed Insurability Option1

 Definition and Terms of Rider1

 Election Rates2

Issues and Shortcomings3

 Inconsistencies between Available and Elected Reports4

 Reliance upon Systems Department4

SAS Program Considerations5

 Universal Life vs. Traditional Policies6

 Calendar vs. Anniversary Year Study7

 Policy Age10

 Termination Date.....11

SAS Program Results12

 Option Age Election Rates13

 Policy Master Record Variables14

Benefits and Advantages16

 Pricing Model Assumptions16

 Studies Unit Procedure18

Conclusions18

This past summer, through an actuarial internship, I was able to learn coding skills in SAS, Statistical Analysis System, and create a program for a Guaranteed Insurability rider that will be used by the company for years to come. This paper will take a look at the terms of the Guaranteed Insurability rider and how election rates can be calculated for differing option ages. Issues and shortcomings of the process in place before the creation of the SAS program will be observed. The considerations that went into this creation will be explained. Ultimately, the results of the SAS program and the benefits of its implementation will be analyzed in this paper.

Guaranteed Insurability Option

Definition and Terms of Rider

The Guaranteed Insurability option is a rider on insurance policies that insures the insurability of the insured. By payment of a modest additional premium for this GIO benefit, an insured has the right to buy additional amounts of insurance at standard rates without evidence of insurability or, in other words, without going through the underwriting process for a second time. This right may be exercised in two ways. The individual first purchases any policy and then has the choice to either be issued a new policy for the additional amount of insurance or to simply increase the amount of coverage that they have on an existing Universal Life policy. Purchase of this additional insurance is only available on established option dates at established option ages. These option dates are defined as the policy anniversary when the insured reaches ages 17, 22, 25, 28, 31, 34, 37, 40, 43, 46, and 49. The SAS program that I coded for my internship project calculated election rates for these listed option ages.

Election Rates

An election rate is essentially a ratio between the amount of additional coverage that Guaranteed Insurability policyholders decided to purchase and the amount of coverage that the policyholders had available that could have been purchased. For example, the election rate of this company in 2013 for age 17 is around 19%. This shows that for the pooled group of policyholders that have a Guaranteed Insurability Option on their policy and have reached the option age of 17, 19% of the dollar amount of coverage that can be elected will be purchased. These calculations are totaled by observing all of the policies in the Policy Master Record. Each entry has amounts listed for Guaranteed Insurability Available and Guaranteed Insurability Elected. By simply dividing elected by available, the election rate can be calculated. Election rates are important in showing the amount of policies that contain a higher risk than others. Due to the fact that policyholders who decide to elect a Guaranteed Insurability option do not provide evidence of insurability for a second time, these individuals now carry higher risk. Although most insureds will purchase this option simply due to a change in needs and not necessarily because of a greater probability of loss, the amount of risk associated with an individual is raised purely because the policyholder was not underwritten since policy issue. The insurance company is not aware of any conditions or characteristics that the holder may have developed, and sells additional amounts of insurance to the individual at standard rates. A higher election rate expresses that more policyholders have decided to elect their Guaranteed Insurability option and that more policies are now higher risk.

Election rates are an important factor used in pricing. Once calculated, these rates are used as one of the assumptions in the pricing model for the Guaranteed Insurability option. A higher election rate expresses greater amounts of risk for the insurance company, and the company would want to adjust accordingly. Premiums for the Guaranteed Insurability option will rise in order to manage the additional risk. Election rates and other such assumptions for most of the pricing models in the insurance company are calculated by the Studies Unit. It was for this unit that I coded a SAS program that automated the process of the Guaranteed Insurability study.

Issues and Shortcomings

At the company that I interned for, the Guaranteed Insurability option study is conducted about every three or four years, with the last study being performed in 2010. The process in use relied upon not only the Life/Health department but also the Systems/Computer Specialist department. Actuaries required the Systems analysts to send reports from which they could then perform their calculations. The reports that were received from Systems supplied information categorized into several variables on policyholders with a Guaranteed Insurability option. To be specific, the reports provided the qualitative variables of agent, state, policy number, type of policy, option age, option date, and the name of the insured, as well as the quantitative variables of guaranteed insurability amount available and guaranteed insurability amount elected. From the information provided by the Systems department through these reports, the Life/Health department was then able to easily calculate election rates for the

Guaranteed Insurability option to be used in the associated pricing model. The Systems reports, however, did have several shortcomings.

Inconsistencies between Available and Elected Reports

The Life/Health department was working with a number of errors and limitations in the Systems reports when conducting their Guaranteed Insurability study every three years. The major difficulty and most concerning issue discovered in the reports was inconsistency. The Studies Unit received two reports, one that contained information on the policyholders that had amounts of insurance available for election through their Guaranteed Insurability option and one that contained information on the policyholders that elected amounts through their rider. Inconsistencies were appearing between these two reports. For example, policyholders were listed in the report of insureds that elected their Guaranteed Insurability option and amounts were displayed of additional insurance purchased, but these same policyholders were not listed in the report of insured with amounts of insurance available for purchase through this rider. Obviously, an error was present in the Systems program for collecting the necessary data for these reports. These inconsistencies made it difficult for the Studies Unit to calculate reliable election rates and required the Unit to spend more time and effort than necessary on this study. Clearly, a more efficient method or program needed to be created.

Reliance upon Systems Department

Another shortcoming of the reports received from the Systems department was the Studies Unit's reliance upon another department in order to conduct the Guaranteed Insurability study. Under the current process for the study, the actuarial analysts were only able

to work with the information given to them. Election rates were being calculated according to the policyholders' option age, or in other words, the Studies Unit was able to look at the ratio of Guaranteed Insurability coverage that was exercised to the Guaranteed Insurability coverage that was available to be exercised when policyholders reached a certain option age. Other factors besides option age, though, could provide insight into policyholders' decisions concerning their riders. The Studies Unit was interested in seeing if other factors besides option age existed that could help identify which insureds exercised their Guaranteed Insurability option. The higher-risk policies with this elected rider could then be more accurately recognized. By incorporating election rates for more variables into the pricing model for the Guaranteed Insurability option, a more accurate premium could also then be calculated. In order to overcome these shortcomings of the Systems' reports and observe more variables than those provided, I created a SAS program that would be able to collect data and create reports directly for the Studies Unit.

SAS Program Considerations

The Policy Master Record contains information on all of the policyholders of the company. By gathering the data to create the above mentioned reports, the Life/Health department was able to now observe several new variables other than option age pertaining to election rates. Basic descriptors of the policyholder were collected, such as name, birthdate, the state in which they purchased their policy, and also the agent they worked with. Descriptors of the policy were also observed. These included variables such as policy number, the date that the policy was issued, the date that coverage started, and the option age of the policyholder

when they decided to elect their Guaranteed Insurability option. The variables that may provide the most insight into policyholders' election tendencies, however, include gender, whether the policyholder is a smoker or nonsmoker, whether the policy is traditional (meaning either Whole Life or Term) or non-traditional (such as Universal or Variable Universal Life policy), and the duration of time that the policy has been in force before the GIO was elected. Calculated election rates for these last four variables allow the company to observe if certain characteristics of policyholders and their respective policies tend to indicate whether or not said individuals will exercise their Guaranteed Insurability rider. Results of these variable observations were most interesting to the department.

Universal Life vs. Traditional Policies

Observations are possible on various types of policies with a Guaranteed Insurability option. The majority of policies, however, are Universal Life. At this company, about 61% of the policies that exercised their GIO in 2013 were Universal Life and about 69% of the amount of coverage purchased through GIO in 2013 was from Universal Life Increases. By exercising one's Guaranteed Insurability option through a UL increase, a policyholder need not purchase a second policy for the additional coverage purchased. Instead, the individual simply increases the basic amount of insurance that they already have on their existing Universal Life policy. UL increases have been evaluated multiple times over the years and have raised some questions. Primarily, are small UL increases being motivated by agency programs rather than customer need? In order to receive rewards and prizes, an agent must sell a preordained number of policies within the year. Large numbers of small UL increases seem to portray that agents are

convincing their clients to purchase the minimum amount of UL increase, providing no rise in premium for the client but counting towards the agent's total amount of policies sold.

Whatever the motivation for the large amount of Universal Life Increases, the fact remains that the majority of Guaranteed Insurability elections come from these types of policies. The SAS program that was being constructed this summer was required to collect data on not only new policies that were purchased through the GIO but also Universal Life policies that were already in force and simply increased in the amount of coverage. Considering the basis of the Guaranteed Insurability elections required the SAS program to observe the Source Code variable and record the policies with a source code of "Purchased under GIR." Separate programming had to be constructed for the traditional/non-Universal Life policies and the UL increases, one section that filtered base policies with the desired source code and another that filtered riders with the desired source code. This division of policies later requires the program to merge these records together but ensures that all sources of Guaranteed Insurability elections are being observed.

Calendar vs. Anniversary Year Study

Now that the program has been designed to observe both types of elections, traditional policies and Universal Life Increases, the decision as to which type of study to conduct had to be made. Two types of studies exist that allow actuaries to analyze their data, anniversary-year and calendar-year. A calendar-year study observes policies from January 1 to December 31. A policy will be reported in this type of GIO study if the policyholder reaches an option age on their policy anniversary in between these two dates. An anniversary-year study, on the other

hand, observes policies from the previous year's policy anniversary date until the current year's policy anniversary. This type of study has a different observation window for each policy. For example, the Guaranteed Insurability study that I was working on reported on policies in 2013. If a policy had its anniversary in November of every year, then the policy would be observed from November of 2012 until November of 2013. The policy would be reported in this type of GIO study if the policyholder reached an option age on their anniversary date in 2013. Understanding the differences between these two types of studies helped to clarify the before-mentioned inconsistencies that were being observed between the Systems department's Available reports and Elected Reports.

Use of a calendar-year study pertaining to Guaranteed Insurability may present a few problems and requires additional consideration. One essential feature of the Guaranteed Insurability option is a 90-day window during which the policyholder can exercise their available rider. This window allows an individual 90 days from their anniversary date on which they reached an option age to decide upon whether or not they would like to elect their Guaranteed Availability option. A lapse between coverage date and issue date is now a possibility.

The Coverage Date variable will represent the anniversary date on which the policyholder had the option to exercise their rider. The Issue Date variable will portray the date on which the policyholder actually exercised their rider. Due to the 90-day window feature, the issue date may now be 90 days after the anniversary date and no longer in the same calendar year. Following the example from above, if a policyholder has an anniversary on which they reach an option age in November of 2013 but then takes advantage of the 90-day window feature on

their Guaranteed Insurability option, the individual will have their Coverage Date variable in 2013 but their Issue Date variable in 2014.

When conducting a calendar-year study, an analyst must have special consideration for which variable is the deciding factor for observation. If the analyst relies upon coverage date, then policies that have coverage dates in the previous year but issue dates in the current year of study will not be observed. If the analyst relies upon issue date, then policies that have coverage dates in the current year of study but issue dates in the next will not be observed. Understanding this small but significant difference in variable usage helped in clarifying the before-mentioned inconsistencies observed between the Systems department's reports.

In order to create a SAS program for the Studies Unit that would generate reports similar to the ones that were already being received from the Systems department, a closer study of the program specifications was required. It soon became clear that the inconsistencies between the Systems' reports were due to discrepancies in variable usage. According to the specifications, the report that observed policies with a Guaranteed Insurability option available for election used the Coverage Date variable as the deciding factor for inclusion, while the report which observed policies that had elected their Guaranteed Insurability option used the Issue Date variable as the deciding factor. This disconnect between the Available and Elected reports helps to explain the observed contradictions.

The Systems reports had some policies in the Elected observations but not in the Available. These policies accompanied the individuals that had decided to exercise the 90-day window feature and, therefore, would have coverage dates in the previous year, 2012, and

issue dates in the current year of study, 2013. As a calendar-year study was conducted, the Systems' reports included these policies in the Elected report, observing them in 2013, but excluded them in the Available report, observing them in 2012. These discrepancies and errors were noted and corrected in the new SAS program.

A conscious decision as to which type of study should be programmed and which variable should be used for inclusion had to be made this summer when creating the SAS program for the Studies Unit. A calendar-year study was decided upon in order to create both the Available report and the Elected report. This decision now created consistency throughout the SAS program and study, and the errors that were being observed in the Systems department's reports were corrected. The SAS program purposely does not observe policies with a Guaranteed Insurability option that became available in the previous year of study but, due to the 90-day window feature, was not exercised until the current year of study. For the GIO study conducted this summer, the policies with riders available in 2012 but exercised in 2013 were deliberately not observed.

Policy Age

Another required consideration besides type of study and variable of inclusion was the age of the policies being observed. The Policy Kind variable was beneficial in presenting information on the year in which a policy had been issued. Newer policies did not present a problem for coding the SAS program, however, special attention was necessary for older policies, particularly those issued between 1970 and 1981. Option ages ranging from 17 to 49, listed earlier, exist for the newer policies in the Policy Master Record of this company. The SAS

program was coded to detect when a policyholder reached an option age on their policy anniversary in the calendar year of study. For policies issued between 1970 and 1981, though, changes in policy terms over the years only offered option ages ranging from 17 to 40. These policies would have been discarded by the SAS program and not observed in the Guaranteed Insurability study if the Policy Kind variable was not detected. The variable distinction allows the program to notice when these older policies are observed and correctly record them if the policyholder reaches an option age on their policy anniversary in the current year of study. This step in the project construction process required research and exploration of the company's policies and changes over the years.

Termination Date

Research on the company's policies concerning differences in termination code and date was also a necessary step. Termination codes existed for the base policy that the Guaranteed Insurability option was purchased through and also the rider separately. The option always terminated when the base policy terminated, which occurred in several ways. The base policy could have a Termination Code variable that described policy expiration, cash surrender, policy lapse, or change of policy. The Guaranteed Insurability option had a Termination Code variable describing either cancellation or change of policy type for the base policy. The most efficient way to program the SAS study was to disregard policies that did not have a termination code describing the policy as in-force, but termination date had to be viewed as well.

The Policy Master Record of the company presented information on policies at the end of the calendar year. However, not all policies that were terminated by the end of the year

should be disregarded. If a policy had terminated after its anniversary date then the policy should be observed. For example, two policies are observed, both with anniversaries in November but one policy terminating before November and the other terminating after. The SAS program should record the policy that terminated after November in the reports if the policyholder reached an option age on the anniversary date. Here, the policyholder's Guaranteed Insurability option was both Available for election and may even have been exercised before the policy terminated. The policy that terminated before November would not be recorded in either the Available or Elected reports, as the policy was not in force when reaching its anniversary date. By viewing both the Termination Code and Termination Date variables, the SAS program ensures observation of all policies that had a Guaranteed Insurability option in force at the time of policy anniversary.

SAS Program Results

After making careful adjustments for the considerations mentioned above, the completed SAS program can be used to conduct the Guaranteed Insurability study. The Policy Master Record of the company for the year 2013 was the first subject of the new study process. Analysis of the 2013 results reveals the implications of using the SAS program and the extent of information now available to the Life/Health department. The Studies Unit is able to observe several more variables, other than option age, concerning both Guaranteed Insurability policyholders and their accompanying policies. These new variables are able to reveal more about the attentions of an individual as they decide whether or not to elect their GIO. The

Pricing Unit is, in return, able to adjust their model for the Guaranteed Insurability option to reflect these attentions as well.

Option Age Election Rates

Using the new SAS program and analyzing the 2013 data results, the company is able to observe the development of the Guaranteed Insurability rider since the last study was conducted in 2010.

The first observation that can be made is the comparison between the 2013 studies using the Systems reports and the SAS program. By comparing these two results, the company is able to assess the reliability and accuracy of the program that has been created. It can be shown that the election rates calculated for each option age in the SAS study are consistently higher than those rates calculated in the Systems study. This trend is not surprising, however, due to the changes in observation window that have been decided upon for the SAS program. The previous Systems reports were inconsistent, as before mentioned, and therefore election rates were consistently missing data on policyholders that had coverage dates in the previous year, 2012, and issue dates in the current year, 2013. With these discrepancies corrected in the SAS program, election rates would now be higher. The SAS study observes the missing policies and includes the accompanying amounts of Guaranteed Insurability in the Available and Elected reports. With this reasoning in mind, the slightly higher election rates calculated by the SAS program do not cause concern. The newly coded Guaranteed Insurability study program appears to be both reliable and accurate.

A second observation that can be made is that election rates have risen since the last Guaranteed Insurability study was conducted in 2010. In three years, the total election rate of all policyholders deciding to elect their rider increased from 9% to 16.7%. The election rate for each option age is also consistently higher in 2013 than in 2010. This observation leads the company to consider making adjustments in their pricing model. With higher election rates, more policyholders have decided to exercise their Guaranteed Insurability option. This means that a higher percentage of policies have acquired standard coverage without being underwritten. These policyholders may not have a higher probability of loss, but this probability has not been observed or accounted for since policy issue. Due to the higher risk of unaccounted loss, the company's pricing model is expected to calculate a higher Guaranteed Insurability option premium. The rise in election rates since the last Guaranteed Insurability study is an essential observation for pricing model assumptions.

Policy Master Record Variables

Several new variables describing policyholders of the Guaranteed Insurability option are now observable from the data of the Policy Master Record. By looking into these descriptors, the company may be able to more accurately pinpoint where their higher risk policies are and use this historical data to witness whether an individual's characteristics affect their choice to exercise their rider. Gender, smoker/nonsmoker, policy kind, and policy duration are four of the new variables that the company was most interested in observing.

Analysis of the gender variable among policyholders did not return a noticeable difference between groups, but the smoker/nonsmoker characteristic appeared to affect

election rates. From the 2013 SAS program results of the Guaranteed Insurability study, smokers had an election rate of 28.6%, stating that almost 29% of policyholders that had a Guaranteed Insurability rider and were smokers decided to exercise their option and purchase additional coverage. This percentage is relatively higher than the 20.7% election rate for nonsmokers, which expresses that almost 21% of nonsmoking individuals who owned a GIO decided to elect their rider. This difference in election rates appears to suggest that a policyholder who has reached an option age and has the choice to exercise their Guaranteed Insurability option will be more likely to elect if they are a smoker than if they were not a smoker.

Analysis of policy kind does not reveal a surprising conclusion. The 2013 SAS study expresses that Universal Life Increases account for about 70% of the coverage purchased through a Guaranteed Insurability option for the year. This election rate coincides with the percentage expressed earlier calculated through the 2013 Paid For Year End Memo for the company. Whole Life policies, Variable Universal Life Increases, and Term policies account for about 23%, 4%, and 2% respectively of GIO coverage purchased in 2013. Universal Life Increases clearly carry the highest election rate of Guaranteed Insurability policyholders. This rate suggests that an individual who has reached an option age and has the choice to exercise their rider will be more likely to increase their coverage if they own a Universal Life policy than any other type of policy.

Duration of the policy was another variable that I was able to calculate from data in the Policy Master Record and was of interest to the company. The duration variable was divided

into groups of five years, observing policies ranging from zero to five years, five to ten, ten to fifteen, etc.

Analysis showed that policies that were in force between zero to five years had an election rate of 21.38%, which states that about 21% of policies that had a Guaranteed Insurability option available for election and had been in force for less than five years had decided to exercise their rider. Election rates decreased as policy duration increased. This suggests that the longer a policy with a Guaranteed Insurability option is in force the less likely the holder is to exercise their rider.

The purpose of observing these other variables of gender, smoker/nonsmoker, policy kind, and duration is to see if the company can determine driving factors behind a policyholder's decision to exercise or not exercise their Guaranteed Insurability rider when they reach an option age. From the results of the SAS program, it would appear that a noticeable difference exists between election rates concerning smokers/nonsmokers, policy kind, and duration. These three variables look to be deterministic of an individual's likelihood to exercise their Guaranteed Insurability option and may be beneficial as assumptions in the GIO pricing model.

Benefits and Advantages

Pricing Model Assumptions

The driving factors determined by the new SAS program will be able to give the Modeling Unit in the Life/Health department a better idea of which assumptions to incorporate into the pricing model for GIO. Before the creation of the SAS program, the model was limited

to the information that was supplied to the Studies Unit through the reports from the Systems department, i.e. option age. The assumptions can now be modified to observe these other variables.

Currently, the company's Guaranteed Insurability Option pricing model uses election rates and mortality as the base of its assumptions. The mortality assumption is provided by the Studies Unit through a separate Mortality Study which is conducted on an annual basis. The election rate assumptions are calculated through the Guaranteed Insurability Option Study as previously described. These election rates were limited before the creation of the SAS program and were only calculated according to option age. The company may decide to incorporate some other determining factors, besides option age, into the election rate assumptions.

By adding additional variables into the pricing model, the company may be able to more accurately calculate a cost for the Guaranteed Insurability option. Incorporation of more election rate factors may help the company to observe where the majority of their coverage for GIO is being applied. For example, if the company notices that more smokers than nonsmokers are deciding to exercise their Guaranteed Insurability rider, the cost of the option may rise. This rise would be due to the thought that the majority of policyholders that elected their GIO are smokers and, therefore, requiring the company to take on more risk than nonsmokers.

Analysis of the effect of adding additional assumptions into the pricing model was not conducted by the end of my actuarial internship. This was, however, the next step in the process for the company. It remained a task for the Modeling Unit to make the decision if these deterministic factors would be beneficial to the pricing model or if it simply created

unnecessary complexity. The option is now available, though, for the Modeling Unit due to the creation of the SAS program.

Studies Unit Procedure

Whether the Modeling Unit decides to incorporate the new variables from the SAS program into their pricing model for the Guaranteed Insurability option or not, the largest advantage of this new program benefits the Studies Unit. Before my actuarial internship, the Studies Unit in the Life/Health department used a process for the GIO study that required their cooperation with the Systems department. They relied upon Systems' timely creation of reports, from which the Studies Unit would then be able to collect their information for the study. The new process using the SAS program now allows the Studies Unit to move away from this reliance upon the Systems department. The unit will now be able to collect their own data from the Policy Master Record and conduct their Guaranteed Insurability study on their own timeline. The Studies Unit can now rely upon the SAS program that I created for years to come.

Conclusions

Through my internship experiences this past summer, I was able to not only learn the Statistical Analysis System coding language but also about the Guaranteed Insurability option. I was able to create a program for the insurance company that provides them with a more efficient process for GIO analysis. The SAS program allows the Studies Unit to perform the GIO study once a year without reliance on other departments. Examination of the new process also shows that results are both understandable and reliable. This paper portrays the considerations and process of creating this SAS program along with the benefits of its implementation.